

ENGINEERING ANALYSIS

PROJECT DESCRIPTION

On March 2, 2021, the Department received an application from Imperial Aluminum – Scottsboro LLC (Imperial), for a new clean-charge reverberatory furnace. The new 230 ft³ capacity furnace will melt aluminum-zinc alloy at 5 tons per hour maximum throughput. Imperial currently operates two secondary aluminum rotary furnaces and one reverberatory furnace.

Along with the application, Imperial Aluminum returned Synthetic Minor Operating Permit 705-0044-X002, which allowed for the operation of a shredder. That unit has been out of service, and the Department voided the shredder permit effective March 4, 2021.

Imperial Aluminum is considered a synthetic minor source of particulate matter and HAP emissions.

PROCESS DESCRIPTION

Clean charge aluminum sows, zinc slabs, and silicon additive will be fed to the new reverberatory furnace to create an aluminum-zinc alloy that Imperial describes as Galvalume. The furnace will use eight natural gas burners totaling to 8.8 MMBtu/hr heat capacity. The furnace is partitioned into a main hearth and a side-well to locate the recirculation pump; clean material will be charged directly to the hearth. Emissions from the flue and from a hood directly over the furnace door will be emitted together through an uncontrolled stack.

EMISSIONS

Calculations are made on an 8,760 hour/year basis.

For the proposed unit (X006), calculations are based on 5 TPH production rate and 9 MMBTU/hr heat input to the burners in conjunction with the natural gas factors from AP-42 Ch. 1.4. . Particulate matter was calculated using Imperial's requested 2.6 lb/hr particulate matter limit (though estimated actual emissions are approximately a fourth as much).

Emissions for the existing reverb and two rotary furnaces (X001, X003, & X005 respectively) are calculated on a 8760 hr/yr basis using production values and maximum burner values in MMBTU/hr provided in their 2010 SMOP application. For particulate matter and HCl, I used the permitted emission limits. For process VOC and HF emissions, I used factors provided by Imperial in their 2010 application. For products of natural gas combustion including SO₂, CO, VOC, and assorted HAPs, I used AP-42 Ch. 1.4 factors, except NOX for which Imperial provided a more conservative, vendor-derived factor.

	Pollutant	X001	X003	X005	X006	Totals
Criteria Pollutant Emissions (TPY)	PM	26.37	26.37	26.37	11.39	90.49
	SO ₂	0.04	0.03	0.03	0.02	0.12
	NO _x	11.83	11.83	11.83	3.86	39.34
	CO	5.77	3.61	3.61	3.25	16.23
	VOC	1.43	1.11	1.11	0.21	3.87
	Total HAPs	4.73	4.70	5.07	0.07	14.57
GHG (TPY)	CO _{2e}	8,206.15	5,128.84	5,128.84	4,513.38	22,977.22

Table 1 – Facility Potential Emissions

LIMITS

Given the difference in the PTE derived from 2.6 lb/hr PM limit in Table 1 and the expected PM emissions in the application, Imperial could be expected to stay well under the proposed SMOP limit. Imperial will be required to use only natural gas and only melt clean charge, as stated in the application. The <5 TPY of NO_x and CO expected from this project would not increase the Imperial's facility-wide PTE for those criteria pollutants above 100 TPY, per Table 1.

Imperial's synthetic minor source status accounted for the 5.75 lb/hr PM limit and 4,000 hr/yr production limit in the X002 shredder permit. Because that permit has now been voided as a result of this project, and because this proposed X006 alloy furnace's PM emissions, at 2.6 lb/hr and 8,760 hr/yr, would have a lower PM PTE than that voided permit, the facility's synthetic minor status would not change if this project were implemented.

REGULATIONS

STATE REGULATIONS

ADEM Admin. Code r. 335-3-4-.01 "Visible Emission"

Rule 335-3-4-.01(1)(a) states that no person shall emit to the atmosphere from any source of emissions, particulate matter of an opacity greater than twenty percent (20%) over a six (6) minute period. **Rule 335-3-4-.01(1)(b)** states that during one six minute period in any sixty minute period a person may discharge into the atmosphere from any source of emissions, particulate of an opacity not greater than that designated as forty percent (40%) opacity. The furnace's uncontrolled stack would be subject to this regulation. Clean charge furnaces are expected to have negligible opacity. However, if visible emissions are observed, the opacity should be determined using Method 9 of 40 CFR Part 60 Appendix A and corrected.

ADEM Admin. Code r. 335-3-4-.04, "Process Industries - General"

Rule 335-3-4-.04(1) states that no person in a Class 1 County shall emit particulate matter greater than the amount determined by the equations below:

When $P < 30$, $E = 3.59P^{0.62}$

Where P = Process weight in tons per hour

And E = Emissions in pounds per hour

The hourly particulate matter limit is dependent on the process weight over a given hour, and the limit will be given in the permit as a formula. However, Imperial's application indicates at maximum 5.025 TPH of material to the furnace; therefore, the maximum particulate emission limit on the furnace would be 9.77 lb/hr. However, this is superseded by the chosen, more stringent SMOP limit of 2.6 lb/hr.

ADEM Admin. Code r. 335-3-14-.04, "Prevention of Significant Deterioration (PSD) Permitting"

Secondary metal production facilities are listed as one of 28 source categories listed in in ADEM Admin. Code r. 335-3-14-.04(2)(a)1 as having a 100 TPY major source threshold for criteria pollutants. Based Table 1 and given that the proposed project would not increase PM PTE, the facility would not be expected to exceed the 100 TPY threshold. A facility must address PSD regulations for Greenhouse Gases (CO₂, N₂O, and CH₄) only if that facility is major for criteria pollutants. Per Rule 335-3-14-.04(2)(a)1(i)&(ii), no PSD review would be necessary for this project.

ADEM Admin. Code r. 335-3-14-.06, “Determinations for Major Sources in Accordance with Clean Air Act Section 112(g)”

This regulation applies to major sources of hazardous air pollutants (HAPs) constructed after March 27, 1998. Since this facility is not a major source of HAPs, a 112(g) case by case MACT review would not be necessary.

ADEM Admin. Code r. 335-3-15, “Synthetic Minor Operating Permits (SMOPs)” and 335-3-16, “Major Source Operating Permits (MSOPs)”

As discussed, the facility’s PM PTE prior to this project was less than 100 TPY. After returning SMOP X002 for the shredder, which allowed for 5.75 lb/hr PM at 4,000 hr/yr, the facility will not increase its PM PTE with the new furnace limited to 2.6 lb/hr. The facility is also a synthetic minor source for HCl, but the insignificant amount of HAP emissions expected from this project are all derived from burning natural gas; no HCl is expected to be emitted from this furnace. Given the above and given that Table 1 indicates that total HAPs remain below 25 TPY, the facility will still be considered a synthetic minor source for both PM and HAP. PTE for all other criteria pollutants remains <100 TPY.

Imperial aluminum will be required to charge clean material only and burn natural gas only.

Class I Area

The nearest Class I Area to the plant, the Sipsey Wilderness Area, is greater than 100 kilometers away, and the emissions from the proposed facility are not expected to have a significant impact on the Class I area.

FEDERAL REGULATIONS

40 CFR 60 “New Source Performance Standards”

No subparts within this part are applicable to the proposed facility.

40 CFR 63 Subpart A, “General Provisions”

This subpart is applicable provided that the facility is subject to one of the applicable subparts found under 40 CFR 63 “National Emission Standards for Hazardous Air Pollutants for Source Categories”.

40 CFR 63 Subpart RRR, “National Emission Standards for Hazardous Air Pollutants for Secondary Aluminum Production”

This subpart is applicable to each secondary aluminum processing facility and their constituent group 2 (clean charge, no flux) furnaces. The alloy melted in the furnace is primarily (~55% by weight) aluminum, and it is the Department’s view that this furnace’s melting operations would fall under the §63.1503 of a *secondary aluminum processing facility*.

However, at area sources of HAPs, only the affected sources listed in §63.1500(c) are subject to the requirements of Subpart RRR; unlike the §63.1500(b) list of affected sources at a major source of HAPs, this area-source listing does **not** include clean charge furnaces. Furthermore, the summary paragraphs of §63.1505(a) “Emission Standards”, §63.1506(a) “Operating Requirements”, and §63.1510(a) “Monitoring Requirements” state that for area sources of HAPs, the affected sources listed in §63.1500(c) are subject to Subpart RRR. Therefore, while a group 2 furnace such as the proposed alloy furnace would be considered an “affected source” at a major-source facility and would have requirements to label [§63.1506(b)] and ensure clean charge [§63.1506(o)], this proposed group 2 furnace at an area-source facility has no applicable operating or monitoring requirements.

RECOMMENDATIONS

This analysis indicates that the proposed emission sources would meet the requirements of all federal and state rules and regulations. Based on the expected emissions from Imperial's facility in Scottsboro, I recommend that Imperial Aluminum be issued Synthetic Minor Operating Permit No. 705-0044-X006.

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ADEM

April 13, 2021
Date

DRAFT

IMPERIAL ALUMINUM – SCOTTSBORO LLC

ALUMINUM-ZINC ALLOY FURNACE

SMOPs: 705-0044-X006

Clean Charge Reverb Furnace products of combustion

Data:			AP-42 EF (NG)			Based on NG with Btu/Content of 1020		
H ₂ S mol%		mol%	PM=	7.6	Lb/MMScf	GWP*		*Revised 11/29/2013
Op Hours	8760	Hrs	NO _x =	100	Lb/MMScf	N ₂ O=	298	
Heat Content	1,020	Btu/scf (Ind.)	CO=	84	Lb/MMScf	CO ₂ =	1	
Flowrate	8.824	MScf/Hr (Ind.)	VOC=	5.5	Lb/MMScf	CH ₄ =	25	
Heat Input	9,000,000	Btu/hr	HAP=	1.89	Lb/MMScf			
			SO ₂ =	0.60	Lb/MMScf			
Use btu/scf(EPA) for PM, NO _x , CO, VOC. Factors for EPA STP (also ADEM STP). SO ₂ factor already for Industry STP (from Al. Oil & Gas Board)			(Table C-1 & C-2) 40 CFR Part 98 Sub C GHG Emission Factors for C₃			(Table C-1 & C-2) 40 CFR Part 98 Sub C GHG Emission Factors for C₁		
Ind. STP:	68 °F	14.696 psia	N ₂ O=	0.0006	kg/MMBtu	N ₂ O=	0.0001	kg/MMBtu
EPA STP:	68 °F	14.696 psia	CO ₂ =	61.46	kg/MMBtu	CO ₂ =	53.06	kg/MMBtu
Heat Content	1,020	Btu/scf (EPA)	CH ₄ =	0.003	kg/MMBtu	CH ₄ =	0.001	kg/MMBtu
Fuel HHV Correction Factor	1.000							
Heater Emission Calculations								
Pollutants								
PM	7.6 Lb	9,000 MMBtu	Scf (EPA)	8,760 Hr	1 Ton	1,000	=	0.294 Tons
	MMScf (EPA)	Hr	1,020 Btu	Year	2,000 Lb			Year
SO₂	0.60 Lb	9,000 MMBtu	Scf (EPA)	8,760 Hr	1 Ton	1,000	=	0.023 Tons
	MMScf (EPA)	Hr	1,020 Btu	Year	2,000 Lb			Year
NO_x	100 Lb	9,000 MMBtu	Scf (EPA)	8,760 Hr	1 Ton	1,000	=	3.865 Tons
	MMScf (EPA)	Hr	1,020 Btu	Year	2,000 Lb			Year
CO	84 Lb	9,000 MMBtu	Scf (EPA)	8,760 Hr	1 Ton	1,000	=	3.246 Tons
	MMScf (EPA)	Hr	1,020 Btu	Year	2,000 Lb			Year
VOC	5.5 Lb	9,000 MMBtu	Scf (EPA)	8,760 Hr	1 Ton	1,000	=	0.213 Tons
	MMScf (EPA)	Hr	1,020 Btu	Year	2,000 Lb			Year
HAP	1.89 Lb	9,000 MMBtu	Scf (EPA)	8,760 Hr	1 Ton	1,000	=	0.073 Tons
	MMScf (EPA)	Hr	1,020 Btu	Year	2,000 Lb			Year
CO₂	9 MMBtu	53.06 kg	0.001 Metric Ton	8,760 Hr	1.1023 Tons		=	4,611.20 Tons
	Hr	MMBtu	kg	Year	1 Metric Ton			Year
N₂O	9 MMBtu	0.0001 kg	0.001 Metric Ton	8,760 Hr	1.1023 Tons		=	0.00869 Tons
	Hr	MMBtu	kg	Year	1 Metric Ton			Year
CH₄	9 MMBtu	0.001 kg	0.001 Metric Ton	8,760 Hr	1.1023 Tons		=	0.08691 Tons
	Hr	MMBtu	kg	Year	1 Metric Ton			Year
Mass Sum	4,611.20 Tons	+	0.0087 Tons	+	0.0869 Tons		=	4,611.29 Tons
	Year		Year		Year			Year
	CO ₂		N ₂ O		CH ₄			
CO₂e	4,611.20 TPY	X 1	0.0087 TPY	X 298	0.0869 TPY	X 25	=	4,615.96 Tons
	4,611.20	+	2.59	+	2.17			Year
	CO ₂		N ₂ O		CH ₄			

¹ AP-42 emission factors taken from Chapter 1.4. Based on natural gas with 1020 btu/scf, and corrected in calculations. From Chapter 1.5, propane emission factors are equivalent on a heat basis to methane factors, except the NO_x factor is 1.5x higher.